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Monetary Policy and Wealth Growth: AI-Enhanced Analysis of Dual Equilibrium in Product and Money Markets within Central and Commercial Banking

CHENG, Qishuo [1*] QIN, Lichen [2] XU, Jinxin [3] WANG, Han [4] ZHONG, Yuqiang [5]

[1] University of Chicago, USA
[2] University of Rochester, USA
[3] Southern Methodist University, USA
[4] University of Southern California, USA
[5] Henan Agricultural University, China

**** CHENG, Qishuo is the corresponding author, E-mail: qishuoc@uchicago.edu***

Abstract: In recent years, the rapid development of artificial intelligence technology has promoted the digital transformation of the financial field. Artificial intelligence technology began in the 1950s, and with the development of computer science, big data analysis and other fields, it has entered the third wave. In terms of natural language processing (NLP), new technologies such as generative artificial intelligence and large-scale pre-training models are gradually maturing, and the large language model represented by ChatGPT marks a major breakthrough in related algorithms. This article combines the monetary policy adopted by central banks after the global financial crisis, the examination of wealth growth patterns, and the application of artificial intelligence in financial analysis. In the aftermath of the financial crisis, central banks adopted large-scale asset purchase programs to stabilize financial markets, but they also created inflation risks. However, central banks have been challenging in forecasting inflation, largely because existing forecasting models have failed to accurately account for changes in inflation expectations. It also discusses the importance of wealth growth patterns and the potential role of artificial intelligence in financial analysis. These contents are of great significance for understanding the double equilibrium between central banks and commercial banks in the money market and its impact on the economy.

Keywords: Monetary Policy, Inflation Forecast, The Pattern Of Wealth Growth, Central Bank, Artificial Intelligence.

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1 Introduction

After the outbreak of the global financial crisis, the monetary policy measures taken by the central bank not only stabilized the financial market, but also buried the hidden danger of inflation. [1] After 2008, faced with the challenges of weak demand and financial turmoil, central banks resorted to large-scale asset purchase programs to boost the economy. However, these measures have driven up asset values and led to a build-up of public and private debt, making it difficult for central banks to adjust monetary policy without triggering financial turmoil.

For years, central bankers and experts have failed to accurately forecast inflation. [2-3] One of the main reasons is that their forecasting models assume that inflation expectations will remain stable, which is often not the case.

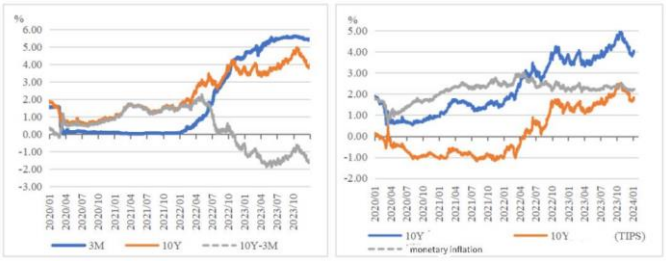

Figure 1 Global monetary and financial volatility

This assumption has repeatedly guided monetary policy, causing central banks to fail to properly diagnose persistently low inflation after the Great Recession and to anticipate the impact of stimulus on inflation during the pandemic. In addition, the central bank found that the judgment of inflation relied on implicit forward guidance, but even the central bank itself could not accurately predict inflation, which made it difficult for the central bank to make accurate judgments when inflation occurred, even more difficult to implement forward guidance to the market [4].

This article examines the impact of central banks' monetary policies on inflation, and discusses the challenges and constraints that central banks face in dealing with inflation, as well as possible solutions. At the same time, we will examine the importance of wealth growth in this process and analyze the potential role of artificial intelligence in financial analysis.

2 Related Work

2.1 Concept of Dual Equilibrium

The concept of "dual economy" originates from economist Lewis (1954,1989). He believes that in the early stage of development of developing countries, there are often two economic sectors, modern and traditional. The modern sector develops by absorbing labor from the traditional sector, and the high wage of the modern sector is the motivation for the surplus labor from the traditional sector to flow to the modern sector. As a result, surplus labor is absorbed by the urban industrial sector, and the wage gap between urban and rural areas is gradually narrowed. When there is no surplus labor force in the agricultural sector, wages will be completely determined by labor supply and demand, and the dual economic structure will realize economic transformation [5]. Lanis and Fei Jinghan (1961,2014) further modified and developed Lewis's theory, giving full attention to the progress of agriculture itself, when the marginal productivity of rural labor increases, the supply of rural labor required by the modern industrial sector will not be completely elastic, but will be limited elastic.

However, there are obvious differences between the dual economic structure of modern China and the path predicted by the classical theory, and it is obvious that the dual economic structure based on market segmentation continues for a long time. Therefore, Chinese economic historians have paid much attention to the uniqueness of the dual economic structure and its development path in modern China [6]. Du Xun Cheng (1990) believed that the process of the traditional economy's transition and development to the level of modernization was almost non-existent in modern China, which showed the long-term coexistence of backward agriculture and handicraft industry and advanced capitalist economy, and produced a series of "antinomy" results. Wu Chengming (1994) believed that the traditional economy was a very developed economic system in ancient and modern times, and the development of the dual economy in modern China did not simply replace the traditional industry with modern industry. Wang Xiang (1991) believes that the social economy of modern China presents typical characteristics of dual economy, which is prominently reflected as a series of imbalances, and dual economy as a transitional form has a certain historical inevitability.

2.2 Interaction between Product and Money Markets

Since income and expenditure are not synchronized in time, firms and individuals must have sufficient monetary funds to pay for their daily needs, and the amount of money required by transactional motives depends on the level of income and on customs and business institutions, which are generally fixed in the short term [7]. Therefore, Keynes believed that the demand for transactions mainly depends on the level of income, the higher the income, the larger the number of transactions, the greater the volume of transactions, so the higher the price of goods and services exchanged, and thus the greater the amount of money needed to meet the daily expenses. Hicks argues that Keynes was right to emphasize that interest rates depend on the supply and demand of money, but wrong to ignore the classical factors of productivity and savings. Hicks believes that monetary and physical factors affect income and interest rate at the same time, that IS, income and interest rate are determined at the same time under the mutual influence of investment, savings, liquidity preference and money supply.

The IS curve is the curve of the interaction between interest rate and income when the product market is in equilibrium. It describes the equilibrium state of the country when total demand equals total supply. Aggregate demand represents total spending, and aggregate supply represents total output (GDP) [8-11], or total income. If we ignore government spending and net exports for the time being, then total national spending includes only consumption and investment, and total income includes consumption and savings. So in equilibrium, C+I=C+S, which is I=S. A curve that connects all Investment (I) to savings (S) in a series of points, so the curve IS called the IS curve (I for Investment, S for Save).

The LM curve is a curve that reflects the correspondence between interest rates and income when the money market is in equilibrium. Currency demand includes transaction prudence demand and speculative demand, namely:

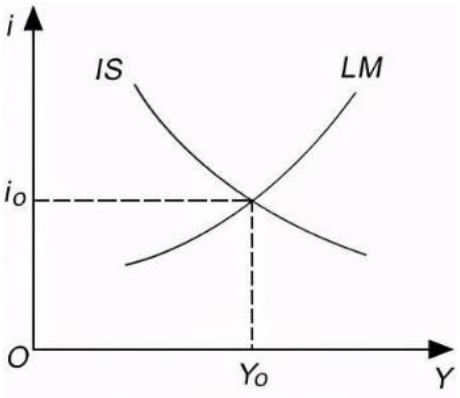

Figure 2 Is-lm model

$$L(PY, r) = L1(PY) + L2(r) \quad (1)$$

In formula (1), L is the demand for money, L1 is the demand for trading and prudent money, L2 is the demand

for speculative money, Y is the income, P is the price index, and r is the interest rate.

When the supply of money equals the demand for money, then:

$$M=L1 (PY) + L2(r) \quad (2)$$

Therefore, the market equilibrium interest rate IS determined when the product market and the money market reach equilibrium at the same time, and the equilibrium interest rate and the equilibrium income are determined by the point E where the IS curve intersects the LM [12] curve.

2.3 Central bank monetary principles

The People's Bank of China should be more humble in setting and implementing monetary policy.

First, a comprehensive forecasting framework should be developed, not limited to one forecasting model. When the economy is affected by a series of interrelated shocks, central banks should not focus their response on one of them. During the pandemic, for example, some central banks focused too much on supply chain disruptions rather than aggressively tackling inflation. [13-15] In response to weak demand, they have changed their inflation forecasting models. Central banks should not blindly follow suit and should avoid changing their forecast frameworks at the first sign of a new change. In addition, when incorporating new concepts into the forecasting framework, it is important to be vigilant against forecasting errors and adhere to the basic principles applicable to different macroeconomic environments.

Second, the policy exit mechanism should be clearly defined to prevent future policy space constraints. Prolonged intervention could exhaust all policy tools, including interest rates and balance-sheet expansion, before the next crisis hits. For example, if a central bank responds to a recession every time it cuts interest rates to zero, it will find it difficult to implement additional stimulus once other shocks occur before the recession ends. In the case of unconventional monetary policies such as forward guidance, a long-term commitment to low interest rates leads to greater constraints on future monetary policy [17]. To this end, the central bank should evaluate each policy measure in terms of whether it will limit future policy space.

Third, clear and easily measurable targets should be set so that the public can assess the performance of central banks. Without a clear framework for evaluating central banks' performance, it will be difficult for the public to judge the effectiveness of central banks' response to the crisis. For example, under average inflation targeting, if the central bank does not specify that it is averaging over several months, it can always explain that average inflation targeting is still in place because the central bank can lower inflation in the future and meet the average inflation target.

2.4 Artificial intelligence and bank money markets

The combination of local currency money market business and artificial intelligence technology is feasible. First, the external policy environment provides support for facilitating the construction of digital transformation of business. The [18]"14th Five-Year Plan" and the "14th Five-Year Plan for Digital Economic Development" mentioned that "digital transformation will drive the transformation of production mode, lifestyle and governance mode as a whole", "constantly strengthen, improve and expand China's digital economy, and provide strong support for the construction of digital China" and "accelerate the digital transformation of financial institutions." In 2022, the General Office of the China Banking and Insurance Regulatory Commission issued the "Guiding Opinions on the Digital Transformation of the Banking and Insurance Industry", and pointed out that "improve the digital level of financial market transaction business", "effectively improve the efficiency of investment transactions and risk management", [19-22]"by 2025, the digital transformation of the banking and insurance industry will achieve obvious results". Second, relevant institutional requirements provide a basis for the rational application of artificial intelligence. The relevant documents of the Association of Interbank Market Dealers and the China Foreign Exchange Trade Center (hereinafter referred to as the Foreign Exchange Trade Center) all point out that "market participants should strengthen the use of instant messaging tools for practitioners to carry out transactions such as bonds and related derivatives" and "market members should carry out offline inquiry business of various trading varieties in the interbank market through the iDeal standard".

Financial institutions utilize AI technologies for data analysis and prediction, which include techniques such as natural language processing (NLP) [23], machine learning (ML) [24], and deep learning (DL) [25]. These technologies can help financial institutions more accurately identify market trends, predict stock price movements, and analyze customer behavior. For example, machine learning algorithms can predict the rise and fall of stock prices based on historical data and market indicators to guide investment decisions. Deep learning techniques can be used to build more sophisticated models to identify potential financial risks and market opportunities. In addition, natural language processing technology can be used to analyze news reports and public opinion on social media to keep abreast of market sentiment and developments. [26] By combining these AI technologies, financial institutions can better understand the market, improve decision-making efficiency, and provide better service to customers.

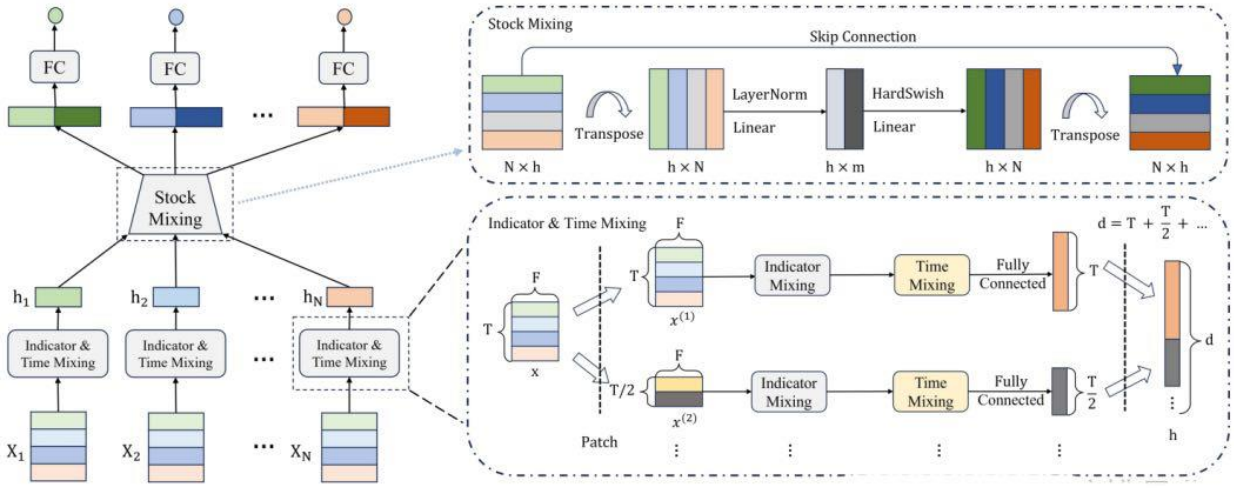

Figure 3 Machine learning financial currency stock price prediction model[27]

These system requirements make it feasible to use the standard inquiry tool iDeal for batch text learning, semantic training and interactive interface development. Third, the development of the business itself promotes the application of artificial intelligence technology. The growth of transaction scale puts forward higher requirements for efficient business achievement and fine management. [28] In the local currency currency market, the head institution has a strong liquidity transmission ability and is the main lender of funds, but the manual presence can not immediately respond to the transaction intention throughout the day, the coverage of customers is limited in a short time, and the need to make a response and judgment based on information such as customer portraits. Therefore, it is necessary to use artificial intelligence technology to abstract out the relatively standardized steps in trading.

3 Case Studies and Insights

3.1 The issuing and trading mechanism of digital currency

Based on the balance sheets of central banks, commercial banks, and the private sector and their interrelationships, this paper studies the mechanism behind the issuance and trading of digital currencies. To facilitate the analysis, this paper assumes that the balance sheets of central banks, commercial banks, and the private sector are shown in Tables 1 to 2, respectively.

As shown in Table 1, central bank assets include three items :(1) claims on the central government, mainly government bonds issued by the central bank; (2) Foreign net assets are mainly funds outstanding in foreign exchange, that is, the central bank buys and sells foreign exchange to form RMB assets corresponding to foreign exchange reserves; (3) Claims on deposit-money banks mainly include reloans, rediscounting and standing credit facilities. The liabilities of the central bank mainly include base money (including cash in circulation and bank reserves) and bonds issued by the central bank (i.e., central bank bills).

Table 1 Central Bank balance sheet

Assets	liabilities
Claims against the central government 500	Net foreign assets 2000
Claim on deposit currency bank 1500	Currency in circulation 1500
Bank reserves 2000	Central Bank Bill 500

Since the central bank of China's digital currency is mainly positioned in the cash type payment certificate (M0), its issuance is essentially as digital cash and circulation, so cash will eventually be held by the private sector. When the public pays their savings in the commercial bank in cash and the commercial bank pays in the form of digital currency, the balance sheet of the commercial bank will be further changed, the digital currency of the asset side will be reduced by 200, and the public savings of the debtor side will be reduced by 200.

As shown in Table 2, the assets of commercial banks mainly include five items :(1) loans to the public; (2) Government bonds held; [29] (3) Claims on other banks and financial institutions mainly refer to claims formed by commercial banks in inter-bank transactions, as well as loans to insurance, securities, fund and trust companies; (5) Deposit reserves of commercial banks at the central Bank, including both legal deposit reserves and excess deposit reserves. The liabilities of commercial banks mainly include the savings deposits of the public, loans from the central bank (mainly including the re-loans of the central bank to commercial banks, standing credit facilities, etc.), and financial bonds issued by commercial banks.

Table 2 Commercial bank balance sheet

Assets	liabilities
Loan 4,000 to the public	Holding government bonds 1000
Claims on other banks and financial institutions 500	Central Bank Bill 500
The total reserves of commercial banks at the central bank are 2000	Public savings 6000
Central banks versus commercial banks Loan 1500	Financial Bonds 500

3.2 Wealth Growth Patterns Examination

The combination of AI and finance has a natural advantage, as both make decisions closely around data. The core contents of the financial industry, such as asset allocation and risk management, are basically carried out around the quantitative analysis of data. Many companies in the global financial market are actively exploring how to use AI technology to improve wealth management efficiency and service quality. These companies are continuously developing and improving AI algorithms to provide more precise and personalized investment recommendations to their clients, and to improve investment returns and reduce risk by automating investment decisions.

In recent years, the application of artificial intelligence on Wall Street has changed the personnel and cost composition of the US financial industry. [30-32] Goldman Sachs, an investment bank, currently has nearly 9,000 digital technicians, more than 25% of its total workforce. Jpmorgan's annual spending on fintech is also growing rapidly, reaching $12 billion a year.

The most outstanding application result of the combination of wealth management and artificial intelligence is intelligent advisory, that is, financial institutions use artificial intelligence technology to provide wealth management services, to a certain extent replace the traditional manual investment advisory function, simplify information acquisition and customer service processes on the client side, improve user experience, and conduct quantitative analysis of market information and investment decisions on the asset side. Seek products that meet customer needs.

The leading US companies in this space, Betterment and Wealthfront, were both founded in 2008 at the onset of the US financial crisis and gained market recognition for their low rates, low costs and convenient services. Betterment uses AI algorithms to automatically adjust portfolios to minimize risk and improve investment returns, and the platform makes asset allocation and trade execution based on risk appetite by evaluating investor information and wealth goals. Wealthfront relies on machine learning algorithms for asset allocation, tax optimization, and smart rebalancing. [33] Such fintech startups not only enhance the investment experience of current investors, but also reach non-high net worth people that traditional investors have not been able to cover.

Established wealth management firms are also following the trend of intelligent investment advisers, and have launched artificial intelligence financial applications, such as Schwab Advisor Portfolio Connect portfolio management platform, by serving independent investment advisers, Achieve the goal of reducing system administration costs and workload, simplifying operations, and close customer connection; BlackRock's Aladdin platform uses artificial intelligence algorithms to analyze market data, news events and comments on social media to predict market trends and stock performance, and to automate asset allocation based on clients' investment goals and risk appetite to help clients achieve the best investment returns.

At the same time, [34] China's residents' wealth has grown rapidly in the past decade. Data show that China's middle-income population has increased 54 times since the beginning of the 21st century, reaching about 400 million people, and the scale of personal investable assets has exceeded 200 trillion yuan. The overall wealth scale is growing rapidly, and the individual needs of people with different wealth scales are prominent, which puts higher requirements on the ability level of wealth management institutions. In the face of diverse needs and large customer groups, how to use artificial intelligence to achieve cost-minimization asset allocation and management has become a new topic for wealth management institutions in this era. In particular, since the end of 2021, the regulatory authorities have issued a series of fund advisory business guidance documents directly related to artificial intelligence advisory business, further clarifying the core of the era of "buyer advisory" and strengthening the "user-centered" business development focus of wealth management.

3.3 Application prospect of artificial intelligence in money market

After more than 20 years of development, the transaction mechanism of the inter-bank market continues to evolve, the product sequence continues to improve, the service quality continues to improve, and the degree of openness continues to improve, which greatly meets the diversified transaction needs of the market and promotes the continuous improvement of the market price discovery function. With the development of artificial intelligence leading the new trend of the industry, the redefinition of the division of labor between "human" and "machine" in the field of financial markets and the reshaping of new business forms have received widespread attention. In the future, artificial intelligence technology has practical possibilities in multiple scenarios such as intelligent trading, transaction assistance, investment research and analysis.

One is in smart trading [35]. Continue to improve the semantic recognition ability of intelligent trading robots, cover more business scenarios and patterns, and improve business efficiency and process specifications; Build electronic trading platform and quantitative trading system, improve the automation level of business, carry out intelligent market making and quotation services according to internal strategies, expand the breadth and depth of trading quotation coverage, and effectively improve the market making power, market activity and influence of market makers.

The second is in the transaction assistance. Build internal and external AI employees, support online Q&A, information retrieval and other functions, answer questions about systems, procedures and other aspects, and conduct simple interaction with customers based on large models and other technologies; Build a digital trading engine that is coordinated between the front, middle and back office, achieve intelligent trading decisions, agile trading processes, refined business control, flexible monitoring and analysis, effectively assist trading decisions, improve risk monitoring capabilities, and improve transaction efficiency.

Third, in the aspect of investment research and analysis. Solve the difficulties in data collection, information analysis, integration and utilization, build an integrated investment research platform, and promote the transition from empirical decision-making to data decision-making; Based on AIGC (Artificial intelligence content generation), RPA, OCR (optical character recognition) and other technologies, improve the digital and intelligent level of investment decision and operation analysis, and strengthen the system's support ability for business decision making and risk control.

In the future, the extensive application of artificial intelligence will boost the digital transformation of the financial market, lead the development of the interbank market to a smart, efficient and standardized direction, and enable the transaction business to reduce costs and increase efficiency, which is of great significance to the market and participating institutions.

4 Conclusion

Combining the monetary policies adopted by central banks after the global financial crisis, an examination of wealth growth patterns, and the application of artificial intelligence in financial analysis, this paper explores in depth the impact of central bank monetary policies on inflation, the challenges faced by central banks in forecasting inflation, and the potential role of artificial intelligence in the financial sector. In terms of financial market volatility, the large-scale asset purchase program adopted by the central bank has stabilized the financial market, but also brought inflation risks. However, the existing forecasting models have failed to accurately predict the changes in inflation expectations, which makes it difficult for the central bank to timely adjust monetary policy without triggering financial turmoil. In addition, the paper discusses the importance of wealth growth patterns and the prospects of AI applications in financial analysis.

On the other hand, the paper further explores the application of artificial intelligence in the financial sector by analyzing central bank monetary policy and central bank forecast challenges to inflation, as well as the importance of wealth growth patterns. By introducing the application cases and prospects of artificial intelligence technology in the financial field, this paper points out the potential role of artificial intelligence technology in financial analysis, including improving the ability to identify market trends, predict stock price trends and analyze customer behavior, so as to improve the efficiency of financial decision-making and service quality. Finally, the paper emphasizes the application prospects of artificial intelligence technology in the intelligent trading of money market, transaction assistance and investment research and analysis, and believes that artificial intelligence technology will promote the digital transformation of financial market, reduce the cost and improve the efficiency of transaction business, which is of great significance to the market and participating institutions.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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About the Authors

CHENG, Qishuo

Department of Economics, University of Chicago, Chicago, IL, USA.

QIN, Lichen

Department of Computer Science, University of Rochester, Rochester, NY, USA.

XU, Jinxin

Department of Cox Business School, Southern Methodist University, Dallas, TX, USA.

WANG, Han

Department of Mathematics, University of Southern California, Alhambra, CA, USA.

ZHONG, Yuqiang

Department of Information and Computer Sciences, Henan Agricultural University, Shenzhen, Guangdong, China.

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